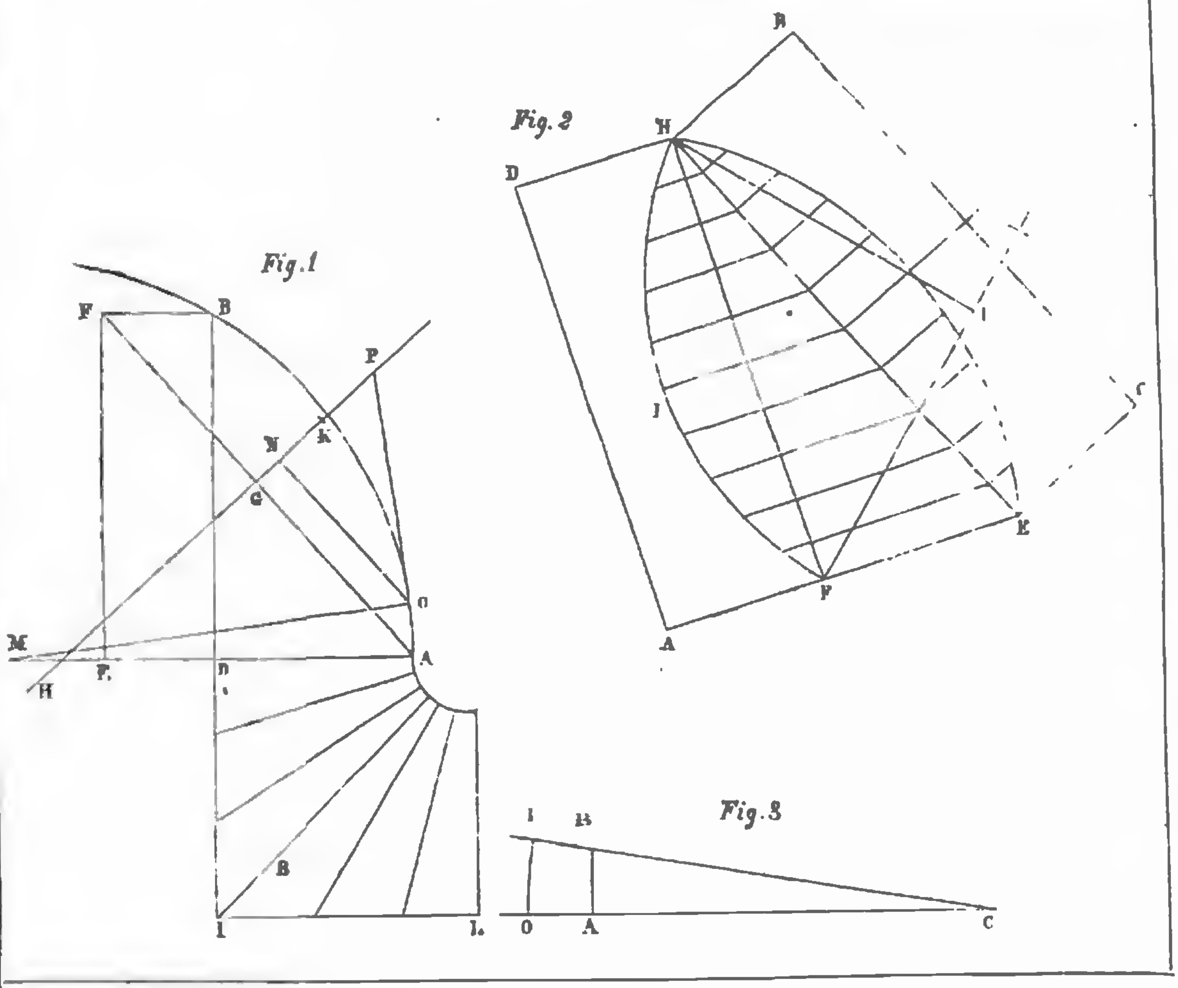
GOTHIC GROINS.



GOTHIC GROINS.

Sir,—As you frequently take occasion to lay before your numerous readers such theories and useful rules as tend to the advancement of branches of the building art, I venture to send you a few remarks on the construction of the varying ribs of a Gothic groin, with a practical method of forming them from a given radius of a circle for one rib, accompanied by the requisite figures and their explanations.

As Gothic groins are constructed in a variety of complicated forms, it will be requisite to give, in addition to the accompanying figures, a brief description of such a groin whose form it is intended to bring under consideration in this article, and which is as follows:—

Such whose several ribs spring at equal distances from the centre of a circle on the cap of a pillar or corbel, and each rib having the same transverse section, and all rising to the same height, but have their spans of unequal length, and generally of a rectangular form upon the plan. This latter form, however, may sometimes be otherwise.

If this description of a groin be clearly comprehended, it will readily appear that in such a construction as the above, where several ribs spring from a portion of the circumference of a circle, and each rib has the same transverse section, that it would require a portion of the whole of the several ribs to be of the same curvature at their springing, in every such like case, whatever the given curve may be. In the present instance, this portion would require to be of equal radii: were it otherwise, the ribs would not intersect truly; but it must be observed here, that the intersections of the several ribs will necessarily be limited in their length, that is, if the ribs be formed on the principle shewn in the method which is given with these short remarks. The quantum of this length in all cases will depend greatly on the difference betwixt the span of the given rib and that of the one required; but this will be more clearly understood by the explanations which accompany the several figures. It must be understood that the whole of the several ribs are to stand perpendicular over their plan. Then let the rectangle ADIL, fig. 1, represent one quarter of the plan, of such a groin, which has been already noticed in the foregoing brief remarks, or something less than one quarter to allow for horizontal ribs. Let the line AM, fig. 1, be the given radius of a circle, and the arc AB a portion of the circle, which will represent a side or wall rib, and the distance AD its span. Let the distance AE be the span of the rib marked B on the plan, and let the distance DB or EF be the rise or height of the ribs. Draw AF, and bisect it perpendicularly in G, with the line HK; then AF will be a double ordinate to an ellipse, and the line HK, will represent a portion of the transverse axis, whose length will be equal to the given diameter of the circle. At a small distance from the springing line in the arc AB, take the point O, and from O draw the radiating line OM; also from O draw OP, perpendicular to OM, meeting HK, prolonged to P, in P, then the line OP will be a tangent to the arc AB; also from O draw ON perpendicular to HK. Let D = the given diameter of the circle, or transverse axis of the ellipse, and a = NP, and y = NK, the abscissa required. Then by the property of the ellipsis, we have,

$$y = \frac{1}{2}\left(D + a \pm \sqrt{D^2 + a^2}\right).$$

This theorem may be performed by construction in a very simple manner. Thus, if a right-angled triangle, BAC, be constructed as is shewn in fig. 3, with its base, AC, equal in length to the given radius of the circle, or the semi-axis major of the ellipse, which is the same, and its perpendicular, BA, equal to half the distance, NP, fig. 1. Then let AC = a, AB = c, and let the hypothenuse BC = d; by Euclid, book 1, proposition 47, $a^2 + c^2 = d^2$, consequently, the length, BC, of the hypothenuse of the triangle, BAC, is equal to the root required. Then prolong the base, AC, of the triangle, to O, and make the distance, AO, equal to half the distance NP, fig. 1; and from the point C, with the distance CO, describe an arc, meeting the hypothenuse, BC, prolonged to I; in I, then, the distance, BI, will be the abscissa required.

On the plane BCEH, fig. 2, describe an arc with the given radius, and make its height equal to the distance BI, fig. 3, added to the distance NG, fig. 1, and project it on another plane DAFH, as shewn in the figure, whose length is equal to the double ordinate. AF, fig. 1: then the elliptic arc, HIF, will be the form of the rib required. From F, with the distance AE, fig. 1, describe an arc; from H, with the distance EF, fig. 1, describe another arc, intersecting the former at I; draw the lines, HI and FI. For any other varying rib proceed in the same manner.

In the above instance, it will be found that a portion of the arc, HIF, equal to one-third of its whole length from either extremity, will be of the same curvature as that of the given circle, and, consequently, when the whole of the ribs are formed, as shewn above, and placed in their relative positions, this portion will be of equal radii as required. In constructing the working drawings for such a structure as the above, the several ribs would be more readily formed by using the trammel.

It will no doubt be observed, that the method of drawing a tangent, as shewn in the figure, is true in the case of a circle, but not so in that